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Respectfully submitted,

J. Mike Amerson
Reg. No. 35,426
WILLIAMS, MORGAN & AMERSON
10333 Richmond, Suite 1100
Houston, Texas 77042
(713) 934-4055
(713) 934-7011 (facsimile)

ATTORNEY FOR APPLICANTS

Date: June 27, 2003

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Die angehefteten Stücke sind eine richtige und genaue Wiedergabe der ursprünglichen Unterlagen dieser Patentanmeldung.

München, den 10. April 2003
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GRÜNECKER KINKELDEY STOCKMAIR & SCHWANHÄUSSER

ANWALTSSOZIETÄT

GKS & S MAXIMILIANSTRASSE 58 D-80538 MÜNCHEN GERMANY

RECHTSANWÄLTE
LAWYERS

MÜNCHEN
DR. HELMUT EICHMANN
GERHARD BARTH
DR. ULRICH BLUMENRÖDER, LL.M.
CHRISTA NIKLAS-FALTER
DR. MAXIMILIAN KINKELDEY, LL.M.
DR. KARSTEN BRANDT
ANJA FRANKE, LL.M.
UTE STEPHANI
DR. BERND ALLEKOTTE, LL.M.
DR. ELVIRA PFRANG, LL.M.
KARIN LOCHNER
BABETT ERTLE

PATENTANWÄLTE
EUROPEAN PATENT ATTORNEYS

MÜNCHEN
DR. HERMANN KINKELDEY
PETER H. JAKOB
WOLFHARD MEISTER
HANS HILGERS
DR. HENNING MEYER-PLATH
ANNELIE EHNOLD
THOMAS SCHUSTER
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DR. DANIELA KINKELDEY
THOMAS W. LAUBENTHAL
DR. ANDREAS KAYSER
DR. JENS HAMMER
DR. THOMAS EICKELKAMP

PATENTANWÄLTE
EUROPEAN PATENT ATTORNEYS

BERLIN
PROF. DR. MANFRED BÖNING
DR. PATRICK ERK, M.S. (MIT)

KÖLN
DR. MARTIN DROPMANN

CHEMNITZ
MANFRED SCHNEIDER

—

OF COUNSEL
PATENTANWÄLTE

AUGUST GRÜNECKER
DR. GUNTER BEZOLD
DR. WALTER LANGHOFF

—

DR. WILFRIED STOCKMAIR
(-1996)

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Applicant: ADVANCED MICRO DEVICES, INC.
One AMD Place, Mail Stop 68,
Sunnyvale, CA 94088-3453
USA

SYSTEM FOR CHEMICAL MECHANICAL POLISHING COMPRISING AN IMPROVED PAD CONDITIONER

SYSTEM FOR CHEMICAL MECHANICAL POLISHING COMPRISING AN IMPROVED PAD CONDITIONER

FIELD OF THE PRESENT INVENTION

The present invention relates to the field of the fabrication of microstructures and more particularly relates to a tool for conditioning the surface of a polishing pad in a system for chemical mechanical polishing of substrates.

DESCRIPTION OF THE PRIOR ART

In microstructures such as integrated circuits, a large number of elements like transistors, capacitors and resistors are fabricated on a single substrate by depositing semiconductive, conductive, and insulating material layers and patterning these layers by photolithography and etch techniques. The individual circuit elements are electrically connected by means of metal lines. In the formation of these metal lines, a so-called interlayer dielectric is deposited and vias and trenches are formed thereafter in this dielectric layer. The vias and trenches are then filled with a metal, e.g., copper, to provide electrical contact between the circuit elements. In modern integrated circuits, a plurality of such metallization layers comprising metal lines must be stacked on top of each other to maintain the required functionality. The repeated patterning of material layers, however, creates a non-planar surface topography, which may deteriorate subsequent patterning processes, especially for microstructures including features with minimum dimensions in the submicron range, as is the case for sophisticated integrated circuits

It has turned out to be necessary to planarize the surface of the substrate between the formation of subsequent layers. A planar surface of the substrate is desirable for various reasons, one of them being the limited optical depth of the focus in photolithography which is used to pattern the material layers of a microstructures. Chemical mechanical polishing is an appropriate and widely used process to achieve global planarization of a substrate.

Fig. 1 schematically shows a sketch of a conventional system 100 for chemical mechanical polishing. The system 100 comprises a platen 101 on which a polishing pad 102 is mounted. Frequently, polishing pads are formed of a cellular microstructure polymer material having numerous voids such as polyurethane. A polishing head 130 comprises a body 104 and a substrate holder 105 for receiving and holding a substrate 103. The polishing head 130 is coupled to a drive assembly 106. The device 100 further comprises a slurry supply 112 and a pad conditioner 131. The pad conditioner 131 comprises a conditioning head 107 and a conditioning pad 108 attached to the conditioning head 107. The conditioning head 107 is coupled to a drive assembly 109.

In operation, the platen 101 rotates. The slurry supply 112 supplies slurry to a surface of the polishing pad 102 where it is dispensed by centrifugal forces. The slurry comprises a chemical compound reacting with the material or materials on the surface of the substrate 103. The reaction product is removed by abrasives contained in the slurry and/or the polishing pad 102. The polishing head 130, and thus also the substrate 103, is rotated by the drive assembly 106 in order to substantially compensate the effects of different angular velocities of parts of the polishing pad 102 at different radii. In advanced systems 100 the rotating polishing head 130 is additionally moved across the polishing pad 102 to further optimize the relative motion between the substrate 103 and the polishing pad 102 and to maximize pad utilization. The drive assembly 109 rotates the conditioning head 107 and thus also the conditioning pad 108 attached to it. The conditioning pad 108 may comprise an abrasive component like, e.g., diamonds embedded in a matrix. Thus, the surface of the polishing pad 102 is abraded and densified slurry as well as particles that have been polished away from the surface of the substrate are removed from voids in the porous polishing pad 102. This process is denoted as conditioning.

Without conditioning, densified slurry and particles abraded from the substrate 103 would clog pores in the polishing pad 102. Thus, the polishing pad 102 would lose its absorbency such that most of the slurry would flow off the polishing pad 102 too quickly. Due to this degradation of the polishing pad 102, the removal rate in the polishing process would steadily decrease.

Conditioning may be performed after the polishing of one or more substrates 103. This, however, leads to significant variations of the removal rate due to the difference between

the reworked surface of a freshly conditioned polishing pad 102 compared to the exhausted surface present immediately before the conditioning. Alternatively, the pad conditioner 131 is continuously in contact with the polishing pad 102 while the substrate 103 is polished. Thus, a more uniform rate of removal of substrate material is achieved.

Various designs of chemical mechanical polishing devices are known in the art. For example, the rotating platen 101 may be replaced with a continuous belt kept in tension by rollers moving at high speed, or slurry may be injected through the polishing pad 102 in order to deliver slurry directly to the interface between the polishing pad 102 and the substrate 103.

One problem with conventional systems for chemical mechanical polishing is that conditioning pads are consumables, which typically have lifetimes of less than 2,000 substrates. Thus, conditioning pads are expensive consumables, the price of which significantly contributes to the cost of operating a chemical mechanical polishing device.

Another problem with conventional systems for chemical mechanical polishing is that conditioning pads comprising diamonds tend to lose single diamonds, which then may cause serious scratches on the surface of the polished substrate. Depending on the type of the polishing system and the control strategy thereof, a large number of substrates can be affected until the problem is either detected and removed by pad changes, or the diamond is removed by pad conditioning. This can result in high cost for scratched substrates.

In view of the above-mentioned problems, a need exists for a system for chemical mechanical polishing which comprises an improved pad conditioner.

SUMMARY OF THE INVENTION

According to one embodiment of the present invention, a system for chemical mechanical polishing comprises a polishing pad and a pad conditioner being adapted to direct a fluid jet towards the polishing pad.

According to another embodiment of the present invention, a method comprises chemical mechanical polishing using a polishing pad and directing a high-pressure fluid jet towards the polishing pad to condition a surface portion of the polishing pad.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages, objects and embodiments of the present invention are defined in the appended claims and will become more apparent with the following detailed description when taken with reference to the accompanying drawings, in which:

Fig. 1 shows a sketch of a conventional system for chemical mechanical polishing;

Fig. 2a shows a sketch of a system for chemical mechanical polishing according to an embodiment of the present invention;

Fig. 2b shows a sketch of a pad conditioner in a system for chemical mechanical polishing according to another embodiment of the present invention;

Fig. 3 shows a sketch of a system for chemical mechanical polishing according to yet another embodiment of the present invention;

Fig. 4 shows a sketch of a pad conditioner in a system for chemical mechanical polishing according to yet another embodiment of the present invention;

Fig. 5 shows a sketch of a pad conditioner in a system for chemical mechanical polishing according to yet another embodiment of the present invention; and

Fig. 6 shows a sketch of a system for chemical mechanical polishing according to yet another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

While the present invention is described with reference to the embodiments as illustrated in the following detailed description as well as in the drawings, it should be understood that the following detailed description as well as the drawings are not intended to limit the present invention to the particular illustrative embodiments disclosed, but rather the described illustrative embodiments merely exemplify the various aspects of the present invention, the scope of which is defined by the appended claims.

A system for chemical mechanical polishing according to the present invention comprises a pad conditioner which is adapted to direct one or more fluid jets towards the polishing pad. Thus, a mechanical force entry into the polishing pad is achieved which leads to the desired removal of densified slurry and particles abraded from the substrate from the polishing pad and to a recreation of absorbency of the polishing pad.

Fig. 2a shows a schematic side view of a system 200 for chemical mechanical polishing according to an illustrative embodiment of the present invention. The system 200 comprises a platen 201, a polishing pad 202, a polishing head 230, a drive assembly 206, a slurry supply 212, and a pad conditioner 231. The polishing head 230 comprises a substrate 203, a substrate holder 205, and a body 204..

The pad conditioner 231 comprises a high-pressure fluid supply 213, a movable mount 214, and a nozzle 215. The high-pressure fluid supply 213 can comprise well-known means for generating fluids having high pressure like, e.g., a pump, or a bottle of compressed gas and well-known means for supplying the fluid to the nozzle 215 and controlling the flow of the fluid, like tubes and valves. The movable mount 214 is connected to a drive device 217, which is adapted to move the movable mount 214.

In operation, the platen 201 and the polishing head 230 rotate, and the slurry supply 212 supplies slurry to the polishing pad 202 where it is distributed by centrifugal forces. Prior to and/or during and/or after polishing a substrate, the high-pressure fluid supply 213 supplies a fluid having high pressure to the nozzle 215. As the fluid passes through the nozzle 215, the pressure of the fluid decreases. Thereby, elastic energy is released and the fluid is accelerated to high velocity, and a fluid jet 216 is formed which impinges on the polishing pad 202.

Fig. 2b shows a schematic perspective view of the pad conditioner 231; for the sake of convenience, like reference numerals have been used in Figs. 2a and 2b.

The fluid jet 216 may impinge at an approximately perpendicular angle to the polishing pad 202. In other embodiments of the present invention, the fluid jet 216 impinges at an incline to the polishing pad 202.

As the fluid jet 216 impinges on the polishing pad 202, the fluid is decelerated and exhibits force to an area on the polishing pad 202 such that densified slurry and particles abraded from the substrate 203 are removed from voids in the porous pad material. A fluid jet 216 having a high velocity may also abrade the pad material itself.

In one embodiment, the fluid jet 216 can have a substantially cylindrical shape. It can have a diameter that is small compared to the radius of the polishing pad 202. Of course, other shapes or configurations are possible for the fluid jet 216.

The pad conditioner 231 comprises a drive device 217 being connected to the mobile mount 214, which can rotate the mobile mount 214 around an axis substantially perpendicular to the surface of the polishing pad 202. Thus, the nozzle 215 and the fluid jet 216 move within a plane that is substantially parallel to the polishing pad surface, ensuring a constant distance between the nozzle 215 and the polishing pad 202.

In one embodiment of the present invention, the drive device 217 comprises a servo motor that is controlled by a microprocessor in coordination with the rotation of the platen 201.

The drive device 217 is adapted to change the direction of rotation of the mobile mount 214 as the fluid jet 216 approaches the edge of the polishing pad 202 in order to ensure that the fluid jet 216 impinges on the polishing pad 202. Thus, the fluid jet 216 oscillates in a bi-directional circular motion over the polishing pad 202.

Moving the fluid jet 216 over the rotating polishing pad 202 allows a substantially uniform conditioning of the surface of the polishing pad 202 with a fluid jet 216 having a diameter which is small compared to the radius of the polishing pad 202 if the rotational frequency

of the platen 201 and the frequency of the oscillating motion of the fluid jet 216 are coordinated. The motion of the fluid jet 216 relative to the polishing pad 202 may advantageously be controlled so as to avoid parts of the polishing pad 202 from being frequently exposed to the fluid jet 216 while other parts of the polishing pad 202 are rarely or never exposed to the fluid jet 216. In one embodiment this can be achieved if the motion of the fluid jet 216 is controlled to be slow enough such that the fluid jet 216 moves over a distance equal to or less than the diameter of the fluid jet 216 during one revolution of the platen 201.

In other embodiments of the present invention, the ratio between the frequency of the oscillating motion of the fluid jet 216 and the rotational frequency of the platen 201 is a fraction a/b of integers a, b, where a is not an integer multiple of b. Then, the motion of the fluid jet 216 relative to the polishing pad 202 repeats after b revolutions of the platen 201. In one particular embodiment, b is equal to or greater than the ratio between the radius of the polishing pad 202 and the diameter of the fluid jet 216.

The angular velocity of the circular motion of the fluid jet 216 need not be constant; it may be desirable to move the fluid jet 216 faster if it impinges on a point close to the center of the polishing pad 202 and slower if it impinges on a point close to the perimeter of the polishing pad 202. Thus, a more uniform exposure of the surface of the polishing pad 202 to the fluid jet 216 is obtained.

In other embodiments of the present invention, the mobile mount 214 performs a unidirectional circular motion over the polishing pad 102. The drive device may be provided over the surface of the polishing pad 102, similar to the drive assembly 109 shown in Fig. 1 and the dimensions of the mobile mount 214 are such that the fluid jet 216 always impinges on the polishing pad 202 as the mobile mount 214 performs a complete revolution.

If desired, conditioning of the polishing pad 202 can be performed continuously or intermittently while a substrate 203 is polished. To this end, in one embodiment the high-pressure fluid supply 213 is configured to supply one or more high-pressure gas streams as the fluid jet 216. With this configuration, dilation and/or a chemical change of the slurry may substantially be avoided. Appropriate gases may include, without limiting the present invention, e.g., air, nitrogen, carbon dioxide, or a noble gas.

Alternatively, polishing and conditioning can be performed successively. For example, conditioning can be performed after one or more substrates have been polished.

The fluid jet 216 can comprise water, for example, provided as ultra pure water. In other embodiments of the present invention, the fluid jet 216 may comprise another liquid, e.g., an organic solvent. The fluid jet 216 may also comprise a mixture of a liquid and a gas. The fluid jet 216 may also comprise abrasive particles which abrade the surface of the polishing pad 202. Conditioning with a fluid jet 216 comprising abrasive particles and polishing of the substrate 203 may be performed successively to avoid the substrate 203 from being scratched by abrasive particles remaining on the polishing pad.

The high-pressure fluid supply can be adapted to supply different fluids to the nozzle 215. In one embodiment of the present invention, the polishing pad 202 is conditioned by a fluid jet which consists of pure water while a substrate 203 is polished. After the polishing of one or more substrates, conditioning with a fluid jet 216 comprising abrasive particles is performed.

Fig. 3 shows a schematic side view of a system 300 for chemical mechanical polishing according to another embodiment of the present invention. The system 300 comprises a platen 301, a polishing pad 302, a polishing head 330, a drive assembly 306, a slurry supply 312, and a pad conditioner 331. The polishing head 330 comprises a substrate 303, a substrate holder 305, and a body 304.

The pad conditioner 331 contains a high-pressure fluid supply 313, a mobile mount 314, a nozzle 315 and a drive device 317. The high-pressure fluid supply 313 is configured to supply a fluid having high pressure to the nozzle 315 to form a fluid jet 316. The drive device 317 is adapted to move the mobile mount 314 back and forth in a radial direction of the platen 301.

In operation, the fluid jet 316 oscillates in a bi-directional linear motion over the polishing pad 302. Similar to the embodiment of the present invention described with reference to Figs. 2a and 2b, the frequency of the oscillation of the fluid jet 316 and the rotational frequency of the platen 301 are coordinated such that a substantially uniform conditioning of the surface of the polishing pad 302 is achieved.

Advantageously, the pad conditioner 331, with the fluid jet 316 performing a linear motion, requires a smaller amount of free space above the polishing pad 302 than, for example, the pad conditioner 231 where the fluid jet 216 performs a circular motion.

Fig. 4 shows a schematic perspective view of a pad conditioner 431 in a system for chemical mechanical polishing according to yet another embodiment of the present invention. The pad conditioner 431 comprises a high-pressure fluid supply 413, a mobile mount 414, and a drive device 417. A plurality of nozzles 415, 418, 420 is attached to the mobile mount 414. In operation, a fluid flows through the nozzles 415, 418, 420 such that a plurality of fluid jets 416, 419, 421 is formed. These fluid jets 416, 419, 421 are directed to a polishing pad (not shown). The drive device 417 is adapted to rotate the mobile mount 414 around an axis substantially perpendicular to a surface of the polishing pad such that the fluid jets 416, 419, 421 and the nozzles 415, 418, 420 perform a bi-directional circular motion within a plane essentially parallel to the polishing pad surface. The direction of the fluid jets 416, 419, 421 can be perpendicular to this plane.

An advantage of a pad conditioner 431 that is adapted to direct a plurality of fluid jets 416, 419, 421 to the polishing pad is that it is sufficient to pivot the mobile mount 414 by a smaller angle to condition the whole surface of the polishing pad compared to a pad conditioner with only one fluid jet. Thus, the pad conditioner 431 requires a smaller amount of free space above the polishing pad. A further advantage of the pad conditioner 431 described with reference to Fig. 4 is that the force entry into the polishing pad is more evenly distributed over the area of the polishing pad.

In a further embodiment, the drive device 417 is adapted to move the mobile mount 414 in a bi-directional linear motion similar to the embodiment described with reference to Fig. 3.

In other embodiments of the present invention, the system for chemical mechanical polishing 400 may comprise a plurality of nozzles that are attached to a plurality of mobile mounts that can be moved independently by a plurality of drive devices (not shown) to produce the plurality of fluid jets.

Fig. 5 shows a pad conditioner 531 in a system for chemical mechanical polishing according to further embodiments of the present invention. The pad conditioner 531 comprises a nozzle 515 being attached to a mount 514. In operation, a high-pressure fluid supply 513 supplies fluid at high pressure to the nozzle 515. An opening of the nozzle 515 has an elongated shape, such that it emits a line-shaped fluid jet 516. The shape of the fluid jet 516 can be characterized by a first diameter d_1 in a cross-direction and a second diameter d_2 in a lengthwise direction, wherein $d_2 > d_1$. In one embodiment, d_2 equals the radius of the polishing pad used. Then, the whole surface of the rotating polishing pad can be conditioned without moving the fluid jet 516. Thus, the number of moving parts may be reduced.

A further embodiment of the present invention is described with reference to Fig. 6. A system 600 for chemical mechanical polishing comprises a polishing pad 602 being attached to a platen 601 which rotates during operation. The system 600 further comprises a slurry supply 612 and a polishing head 630 comprising a substrate 603, a substrate holder 605, and a body 604. A drive assembly 606 rotates the polishing head 630 during operation of the system 600. A plurality of nozzles 615, 618 are attached to the polishing head 630. A high-pressure fluid supply 613 supplies fluid at high pressure to the nozzles 615, 618 such that fluid jets 616, 619 are created that are directed to the surface of the polishing pad 602. The high-pressure fluid supply 613 and the nozzles 615, 618 together form a pad conditioner, which is attached to the polishing head 630.

The fluid jets 616, 619 are moved over the surface of the polishing pads 602, as the polishing head 630 and the platen 601 rotate. In this embodiment, the rotation of the polishing head 630 is advantageously employed for the motion of the fluid jets 616, 619, such that no additional drive device is required for the pad conditioner. A further advantage of this embodiment is that the surface of the polishing pad is conditioned directly before it encounters the substrate 603, such that it is ensured that a freshly conditioned polishing pad surface is used for polishing the substrate 603.

In one embodiment, the rotational frequency of the platen 601 and the polishing head 630 are coordinated to ensure a substantially uniform conditioning of the polishing pad 602.

In other embodiments of the present invention, the nozzles 615, 618 are arranged around the polishing head 630 so as to form a substantially ring-shaped nozzle assembly. In a further embodiment, one or more of the nozzles 615, 618 may have an arcuate shape to provide an arcuate line-shaped fluid jet, or in still a further embodiment, the plurality of arcuated nozzles may be replaced by a single substantially ring-shaped nozzle. In operation, fluid at high pressure is supplied to the nozzles 615, 618 such that a fluid jet around the polishing head is created.

In the embodiments described above it may be advantageous to use a fluid that substantially maintains the chemistry of the slurry, i.e., the fluid may be a gas, or a chemical reagent may be supplied along with the fluid jet.

In a system for chemical mechanical polishing according to the present invention, the pressure of the fluid being supplied to a nozzle, the size of an opening of the nozzle, and the angle at which a fluid jet impinges on the polishing head can be adapted to the individual application and the used pad material. In a pad conditioner comprising a plurality of nozzles, the individual nozzles may have different diameters, and the individual fluid jets may impinge on the surface of the polishing pad at different angles. The individual fluid jets may comprise different fluids.

A jet moving unit for moving one or more fluid jets over the surface of a polishing pad need not comprise a mobile mount as in the embodiments described above. In other embodiments of the present invention, the position at which a fluid jet impinges on the polishing pad may be controlled by changing a direction of the fluid jet by pivoting a fixed nozzle.

In further embodiments of the present invention, one or more pivoting nozzles are attached to a mobile mount which may be coupled to a drive device. Thus, both the angle at which the one or more fluid jets emitted by the nozzle or nozzles impinges on the polishing pad and the position where it impinges can be varied.

The present invention is not limited to systems for chemical mechanical polishing comprising a rotating platen and a slurry supply as shown in Figs. 1, 2a, 3 and 6. Pad conditioners that are adapted to direct a fluid jet to the surface of a polishing pad may also be used in a sequential linear polisher, which comprises a polishing pad being

attached to a continuous belt kept in tension by rollers, wherein this belt moves at high speed. Slurry may also be supplied directly to the interface between a polishing pad and a polished substrate by injecting it through the polishing pad instead of using a slurry supply above the polishing pad as shown in Figs. 1, 2a, 3 and 6.

Further modifications and variations of the present invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the general manner of carrying out the present invention. It is to be understood that the forms of the invention shown and described herein are to be taken as the presently preferred embodiments.

CLAIMS

1. A system for chemical mechanical polishing comprising:

   a polishing pad; and

   a pad conditioner being adapted to direct a fluid jet towards said polishing pad.

2. A system for chemical mechanical polishing as in claim 1, wherein said pad conditioner comprises:

   a high-pressure fluid supply;

   a nozzle being connected to said high-pressure fluid supply to supply said fluid jet.

3. A system for chemical mechanical polishing as in claim 1, wherein said fluid jet has a substantially cylindrical shape or a substantially rectangular shape.

4. A system for chemical mechanical polishing as in claim 1, wherein a first diameter of said fluid jet is smaller than a second diameter of said fluid jet.

5. A system for chemical mechanical polishing as in claim 1, wherein said fluid jet comprises a liquid.

6. A system for chemical mechanical polishing as in claim 1, wherein said fluid jet comprises water.

7. A system for chemical mechanical polishing as in claim 1, wherein said fluid jet comprises a gas.

8. A system for chemical mechanical polishing as in claim 1, wherein said fluid jet comprises abrasive particles.

9. A system for chemical mechanical polishing as in claim 1, further comprising a jet moving unit being adapted to move said fluid jet.

10. A system for chemical mechanical polishing as in claim 9, wherein said jet moving unit is adapted to move said fluid jet in an oscillating motion.

11. A system for chemical mechanical polishing as in claim 10, wherein said jet moving unit is configured to provide said oscillating motion as a bi-directional circular motion.

12. A system for chemical mechanical polishing as in claim 10, wherein said jet moving unit is configured to provide said oscillating motion as a bi-directional linear motion.

13. A system for chemical mechanical polishing as in claim 9, wherein said jet moving unit is adapted to move said fluid jet in a plane substantially parallel to a surface of said polishing pad.

14. A system for chemical mechanical polishing as in claim 13, wherein a direction of said fluid jet is substantially orthogonal to said plane.

15. A system for chemical mechanical polishing as in claim 9, wherein said jet moving unit is adapted to move said fluid jet in a unidirectional circular motion.

16. A system for chemical mechanical polishing as in claim 9, wherein said pad conditioner comprises a high pressure fluid supply and a nozzle being connected to said high pressure fluid supply to supply said fluid jet, and wherein said jet moving unit comprises a mobile mount, said nozzle being attached to said mobile mount.

17. A system for chemical mechanical polishing as in claim 16, wherein said jet moving unit further comprises a drive device being adapted to move said mobile mount.

18. A system for chemical mechanical polishing as in claim 1, further comprising a polishing head, said pad conditioner being attached to said polishing head.

19. A system for chemical mechanical polishing as in claim 1, further comprising a slurry supply being adapted to supply slurry to said polishing pad.

20. A system for chemical mechanical polishing as in claim 1, wherein said pad conditioner is adapted to direct a plurality of fluid jets towards said polishing pad, said plurality of fluid jets comprising said fluid jet.

21. A system for chemical mechanical polishing as in claim 20, further comprising:

a high pressure fluid supply;

a plurality of nozzles being connected to said high pressure fluid supply to supply said plurality of fluid jets.

22. A system for chemical mechanical polishing as in claim 21, further comprising a mobile mount, said plurality of nozzles being attached to said mobile mount.

23. A system for chemical mechanical polishing as in claim 22, further comprising a drive device being adapted to move said mobile mount.

24. A system for chemical mechanical polishing as in claim 20, further comprising a plurality of jet moving units, each of said jet moving units being adapted to move at least one of said plurality of fluid jets.

25. A method comprising:

chemically mechanically polishing a substrate on a polishing pad; and

directing a high-pressure fluid jet towards said polishing pad to condition a surface portion of said polishing pad.

26. A method as in claim 25, wherein said chemical mechanical polishing and said directing said at least one fluid jet towards said polishing pad are performed simultaneously.

27. A method as in claim 25, wherein said chemical mechanical polishing and said directing said at least one fluid jet towards said polishing pad are performed successively.

28. A method as in claim 25, wherein said fluid jet has a cross-section having one of a shape substantially cylindrical shape, an oval shape, a substantial line shape and an arcuate line shape.

29. A method of chemical mechanical polishing as in claim 25, wherein a first diameter of said fluid jet is smaller than a second diameter of said fluid jet.

30. A method as in claim 25, wherein said fluid jet comprises a liquid.

31. A method as in claim 25, wherein said fluid jet comprises water.

32. A method as in claim 25, wherein said fluid jet comprises a gas.

33. A method as in claim 25, wherein said fluid jet comprises abrasive particles.

34. A method as in claim 25, further comprising moving said fluid jet in an oscillating motion.

35. A method as in claim 34, wherein said oscillating motion comprises a bi-directional circular motion.

36. A method as in claim 34, wherein said oscillating motion comprises a bi-directional linear motion.

37 A method as in claim 25, further comprising moving said fluid jet in a plane substantially parallel to a surface of said polishing pad.

38. A method as in claim 37, wherein said fluid jet is substantially orthogonal to said plane.

39. A method as in claim 25, further comprising moving said fluid jet in a unidirectional circular motion.

40. A method as in claim 25, comprising directing a plurality of fluid jets towards said polishing pad, said plurality of fluid jets comprising said fluid jet.

41. A method as in claim 40, further comprising moving said plurality of fluid jets.

42. A method as in claim 25, further comprising supplying slurry to said polishing pad.

43. A method as in claim 25, further comprising moving said fluid jet and said polishing pad, said moving said fluid jet and said moving said polishing pad being coordinated.

ABSTRACT

A system and method for chemical mechanical polishing of a substrate is disclosed in which a polishing pad is conditioned by directing a fluid jet to the surface of the polishing pad. Thus, the use of expensive consumables, like conditioning pads comprising diamonds, can be avoided. Furthermore, the risk of substrates being scratched by diamonds lost from the conditioning pad is avoided.

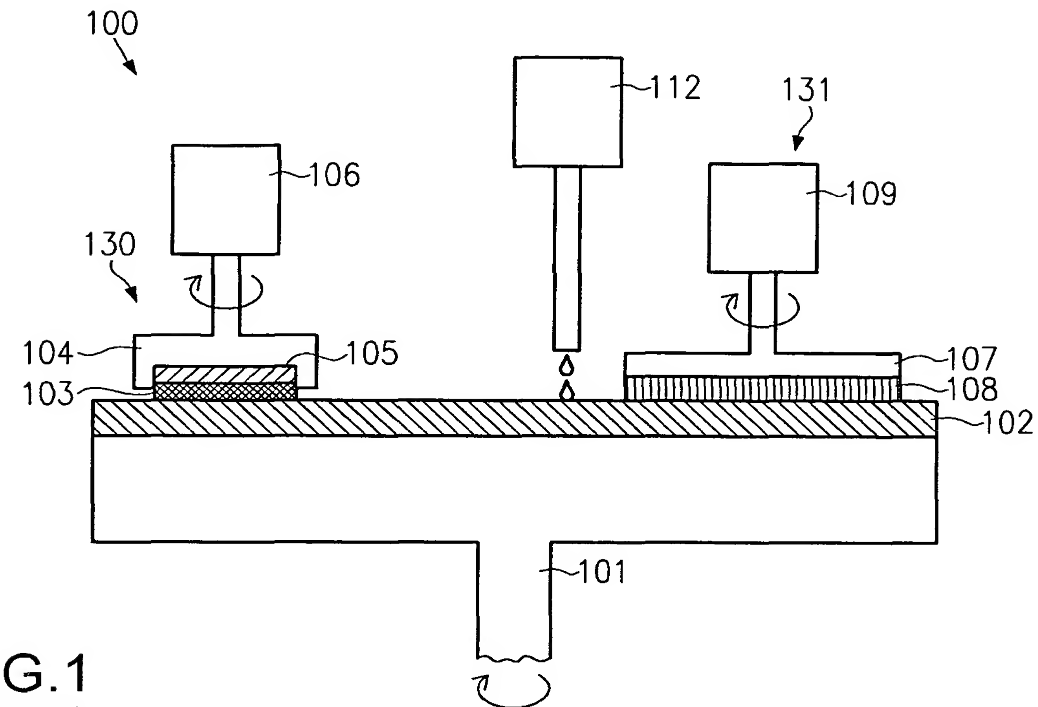

FIG.1
(prior art)

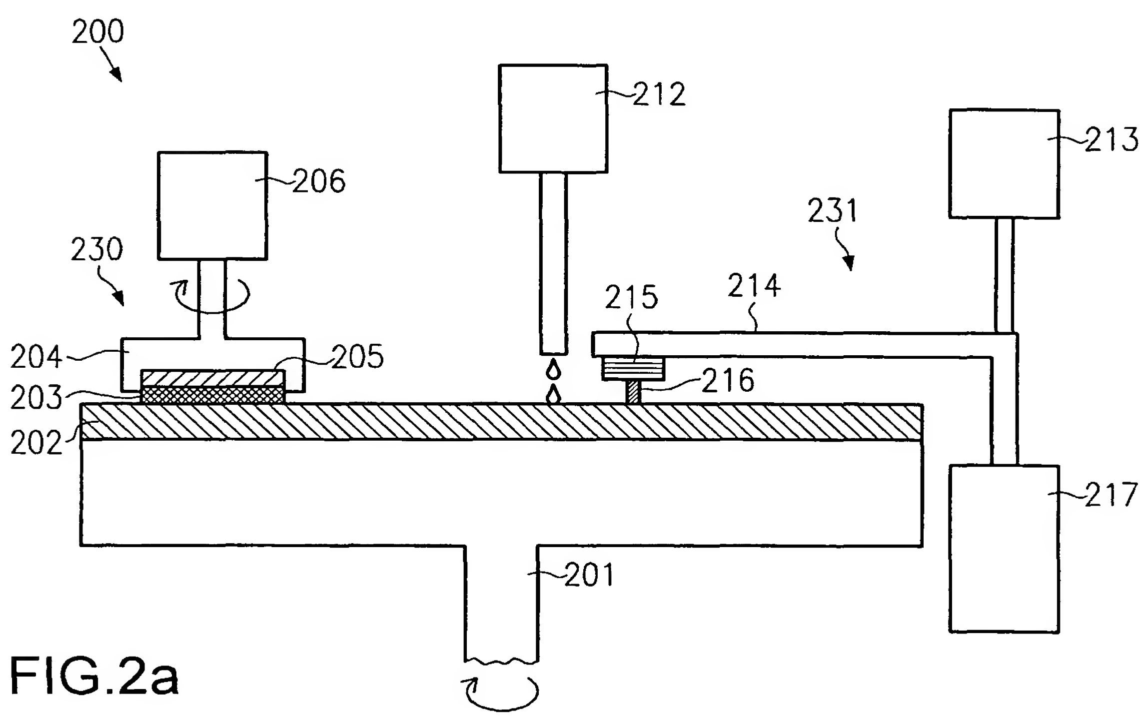

FIG.2a

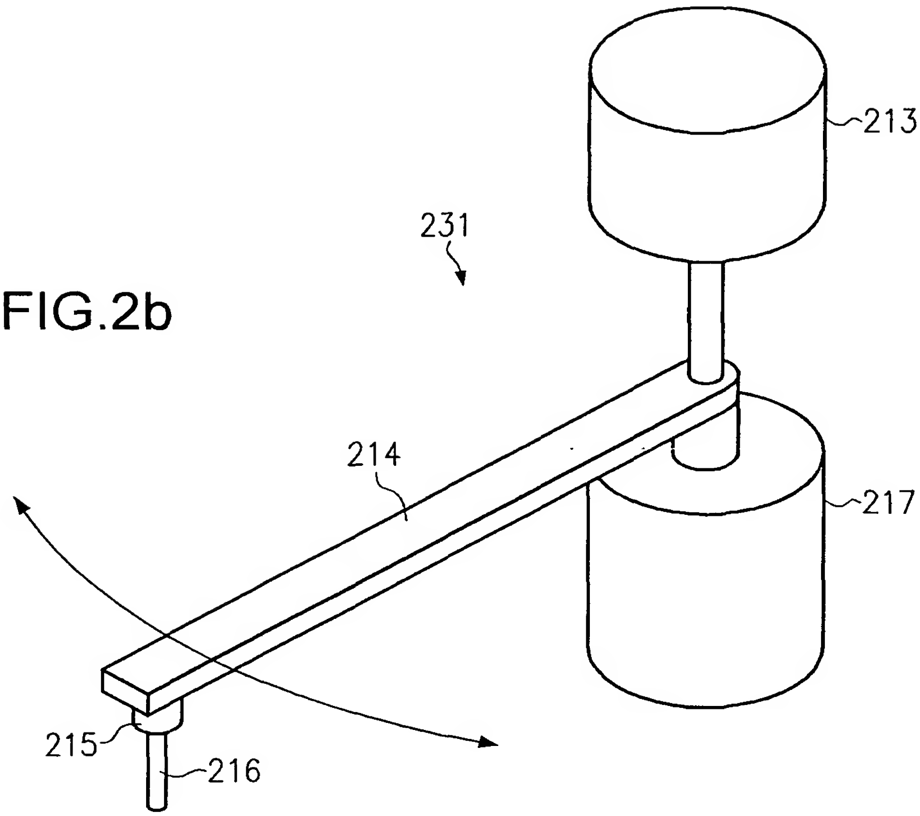

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FIG.2b

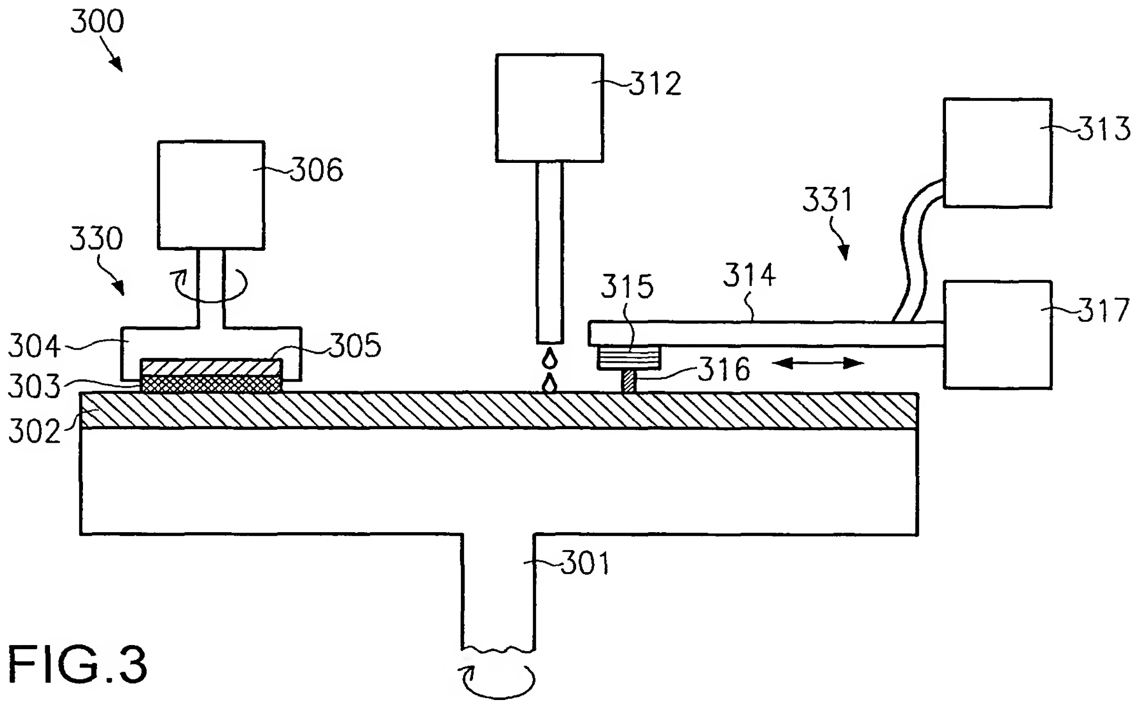

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FIG.3

FIG.4

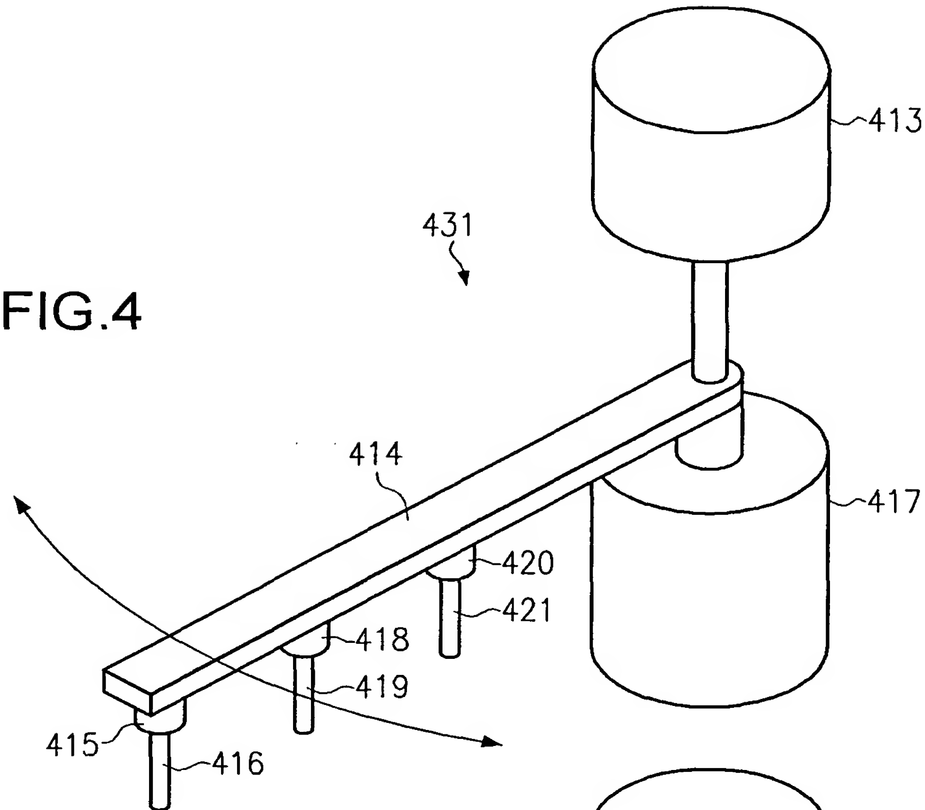
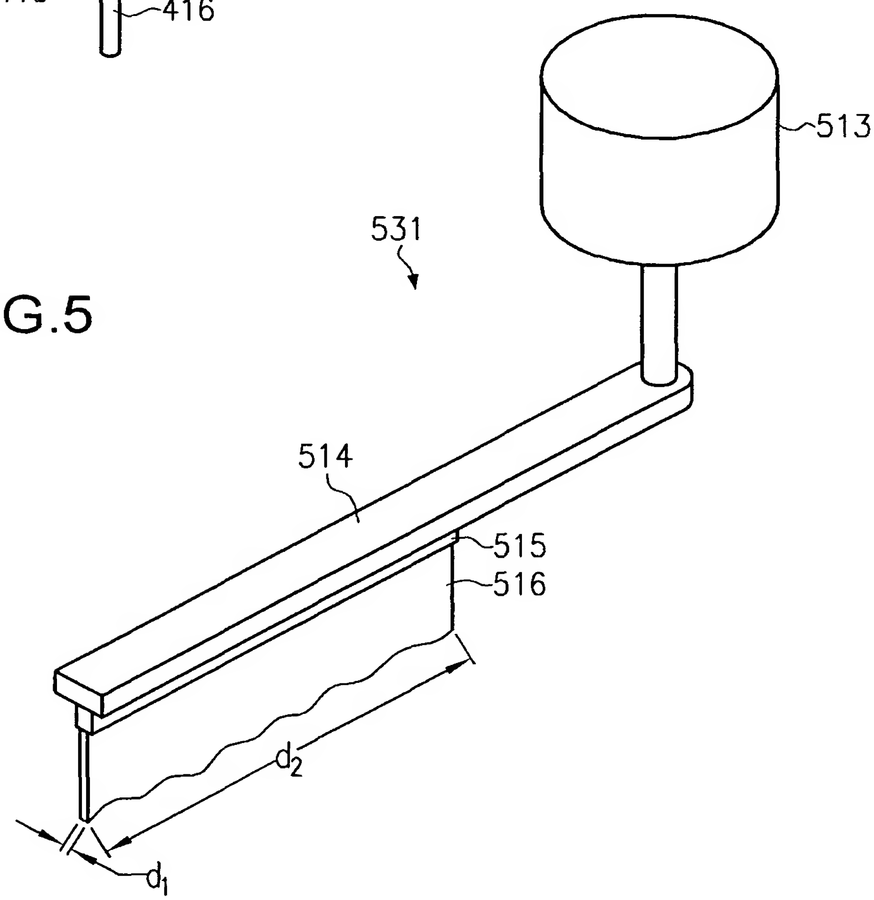


FIG.5



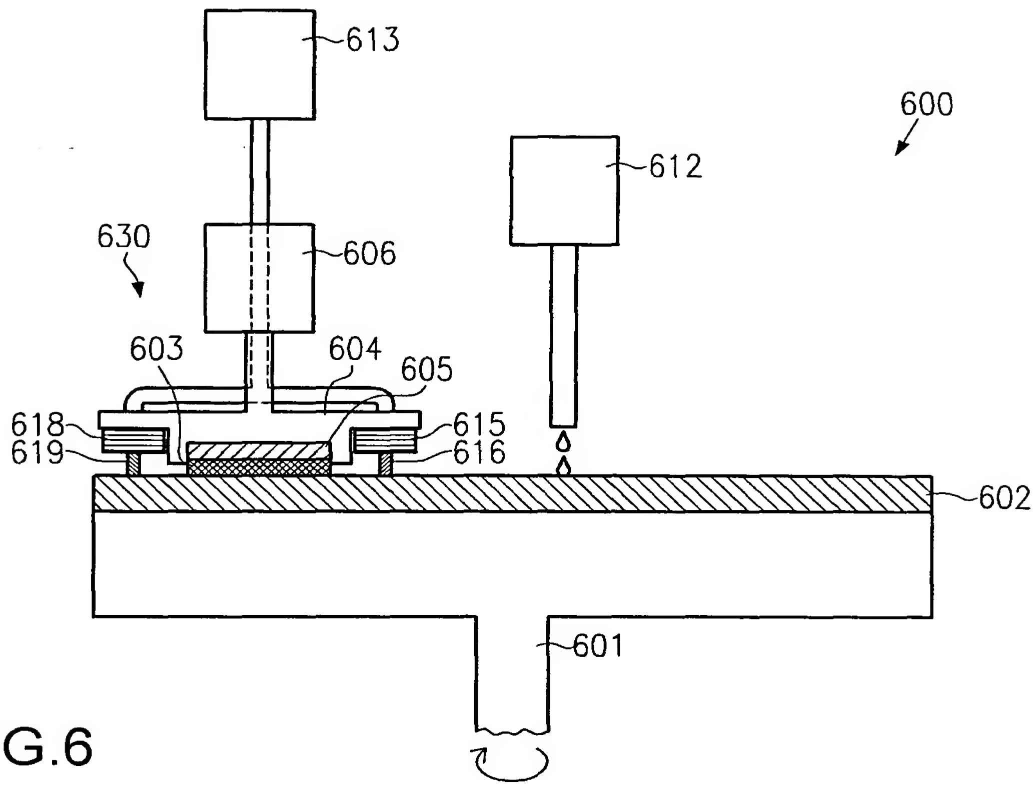


FIG.6